REMARKS

Original Claims 1-73 are pending.

Objections

The drawings have been objected under 37 CFR 1.83(a) for allegedly failing to show the "two-dimensional histogram bins" feature as recited in Claim 68. The specification is also objected to under 37 CFR 1.75(d)(1) and MPEP 608.01(o) for failing to provide proper antecedent bases for the "two-dimensional histogram bins" feature as recited in Claim 68.

These objections are respectfully traversed as it is pointed out that the method for generating a low-distortion area-preserving map for use in stochastic ray tracing computer generated graphics as recited in Claim 68 is supported by the resulting low-distortion area-preserving map of Fig. 20 and described in detail beginning on page 32, at line 9, and extending to page 33, line 11. The act of projecting the resulting three-dimensional surface samples into two-dimensional histogram bins is akin to selectively storing or otherwise arranging data in a particular manner. The data stored/arranged in the act happens to be in two-dimensional histogram bins, which may be operatively configured in RAM 35, of Fig. 1, for example.

Rejections under 35 U.S.C. §102(e)

Claims 65-67 stand rejected as being anticipated by *Xiong* (U.S. Patent No. 6,359,617). Applicants traverse these rejections for at least the reasons stated below. It is respectfully requested that the rejections be reconsidered and withdrawn.

Xiong teaches techniques for generating virtual panoramic images by pair-wise registering rectangular images together and then using an error function in an iterative manner to combine the images in a projective transformation.

Claim 65 is an independent claim directed towards a polar-capped map set for use in computer generated graphics. The polar-capped map set includes a cylindrical projection map, and at least one azimuthal projection map.

Xiong neither discloses nor reasonably suggests such a polar-capped map set. The Office Action points to *Xiong*, col. 8, lines 42-47, as disclosing the polar-capped map set. Closer analysis of *Xiong* shows that *Xiong* is simply reciting a long list of different types of image "geometries and projections possible during the construction and employment of panoramas" using *Xiong's* techniques. Xiong does not, however, disclose a polar-capped map set as recited in Claim 65 that combines a cylindrical projection map and at least one azimuthal projection map.

Claims 66 and 67 depend from independent Claim 65. As such, the exemplary reasons stated above applicable to these claims also. These dependent claims add additional elements/limitations to Claim 43 further distinguishing the claims over the cited art.

Claim 66 recites that the polar-capped map is a stretch-invariant map. This is clearly not described by *Xiong*. Here, the Office Action states that *Xiong* somehow discloses such by simply listing that his techniques may work with equidistant projections. *Xiong* lists various exemplary geometries and projections but does not disclose or otherwise even suggest combining different geometries/projections. Rather, *Xiong's* techniques are directed towards selecting one of these geometries/projections.

Claim 67 specifies that the polar-capped map is a conformal map. This polar-capped map set is not taught nor suggested by *Xiong*. Here, the Office Action points to the listing of "Lambert conformal conic" projections as teaching the polar-capped map of Claim 67. Again, this is just one of many different listed exemplary geometries/projections that *Xiong* felt compelled to mention in column 8. Clearly, *Xiong's* statement does not disclose or otherwise reasonably suggest the claimed polar-capped map.

Rejections under 35 U.S.C. §103(a)

Claims 1-64, 70-73 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *Xiong*. Applicants respectfully traverse these rejections for at least the following reasons and respectfully requested that the rejections be reconsidered and withdrawn.

Claim 1 is an independent claim directed towards a method that includes providing a first texture map for a first portion of a three-dimensional surface, the

first texture map being associated with a first mapping technique, and providing a second texture map for a second portion of the three-dimensional surface, the second texture map being associated with a second mapping technique that is different from the first mapping technique. *Xiong* neither discloses nor reasonably suggests such a method.

By way of example, as previously mentioned *Xiong* does not disclose or suggest nor would *Xiong* tolerate combining in anyway different types of map information. Instead *Xiong* selects images that share the same geometry and/or projection and then works to combine these to form a virtual panorama image. See, e.g., column 8, lines 18-33, where *Xiong* states that "the panorama is constructed on a particular geometry". The two-dimensional images and resulting three-dimensional in *Xiong* need to share a common geometry to support the blending process being taught. For example, *Xiong* teaches that overlapping rectangular images can be blended together using a blending mask after being configured in a Laplacian pyramid.

Claims 2-21, 70 and 71 depend from independent Claim 1. Hence, the exemplary reasons stated above apply to these dependent claims too. These dependent claims add additional elements/limitations to the method in Claim 1 which serve to further distinguish the claims over the cited art.

Claim 2 further recites that the first texture map includes cylindrical projection information for the first portion, and the second texture map includes

azimuthal projection information for the second portion. The cited art fails to disclose or otherwise suggests this method.

Claim 3 states that the method further that includes providing a third texture map for a third portion of the three-dimensional surface, the third texture map being associated with the second mapping technique, and wherein the third texture map includes azimuthal projection information for the third portion. This method is not taught nor suggested by *Xiong*.

In **Claim 4** the cylindrical projection information includes plane-chart projection information. This method is not taught nor suggested by *Xiong*.

Claim 5 specifies that the azimuthal projection information includes equidistant projection information. *Xiong* neither discloses nor reasonably suggests such a method.

Claim 6 recites that the first and second texture maps are stretch-invariant and have a sampling requirement definable as:

$$M_{\text{capped}}(\theta) \equiv M_{\text{equi}}(\theta) + M_{\text{plane}}(\pi/2 - \theta) = 4\theta^2 + 2\pi(\pi/2 - \theta)$$

where θ is a transition angle from a defined point on the surface to where the second texture map is adjacent to the first texture map. The cited art fails to disclose or otherwise suggests this method. Indeed, the Office Action states that this claim if allowable is re-written in independent form.

Claim 7 further states that θ is equal to about 45°. *Xiong* and/or the other cited art does not disclose this. The Office Action also states that this claim if allowable is re-written in independent form.

Claim 8 further includes that providing the first texture map includes hexagonally re-parameterizing the cylindrical projection information using a linear transform. The cited art fails to disclose or otherwise suggests this method. Indeed, the Office Action states that this claim is allowable if re-written in independent form.

Claim 9 further specifies that the linear transform is definable as:

$$\hat{S}(u,v) \equiv S(V(u,v)')$$

where

$$V \equiv \begin{bmatrix} k & k/2 \\ 0 & 1 \end{bmatrix}$$

and $k \equiv 2\sqrt{3}/3$.

This method is clearly not described by *Xiong* as noted in the Office Action, which states that this claim is allowable if re-written in independent form.

In **Claim 10** the first texture map includes Mercator projection information for the first portion, and the second texture map includes stereographic projection information for the second portion. *Xiong* neither discloses nor reasonably suggests such a method.

Additionally, **Claim 11** adds that the method further includes providing a third texture map for a third portion of the three-dimensional surface, the third texture map being associated with the second mapping technique, and wherein the third texture map includes stereographic projection information for the third portion. This is clearly not described by *Xiong*.

Claim 12 further recites that the first and second texture maps are conformal and have a sampling requirement definable as:

$$M_{\text{capped}}(\theta) \equiv M_{\text{stereo}}(\theta) + M_{\text{Mercator}}(\pi/2 - \theta) = 16\tan^2(\theta/2) + \pi\ln\left((1+\cos\theta)/(1-\cos\theta)\right)$$

where θ is a transition angle from a defined point on the surface to where the second texture map is adjacent to the first texture map. *Xiong* and/or the other cited art does not disclose this. Indeed, the Office Action states that this claim is allowable if re-written in independent form.

Claim 13 states that θ is equal to about 47.8°. Again, this method is clearly not described by *Xiong*. According to the Office Action this claim is also allowable if re-written in independent form.

Claim 14 recites that the cylindrical projection information includes information selected from at least one type of projection information selected from a group comprising plane-chart projection information, equal area information, and Mercator information. *Xiong* neither discloses nor reasonably suggests such a method.

Claim 15 specifies that the azimuthal projection information includes information selected from at least one type of projection information selected from a group comprising equidistant projection information, stereographic projection information, gnomonic projection information, and equal area projection information. The cited art fails to disclose or otherwise suggests this method.

Claim 16 adds that the first portion is significantly adjacent to both the first and second portions, such that the first portion separates the second and third portions. This is clearly not described by *Xiong*.

In **Claim 17** the three-dimensional surface is curvilinear. *Xiong* neither discloses nor reasonably suggests such a method.

Claim 18 further recites that the three-dimensional surface includes a spherical surface. *Xiong* neither discloses nor reasonably suggests such a method.

Claim 19 further specifies that providing the first texture map further includes generating the first texture map using the first mapping technique, and providing the second texture map further includes generating the second texture map using the second mapping technique. This method is not taught nor suggested by *Xiong*.

Claim 20 recites that at least one of the first and second texture maps includes information based on a rectangular sampling matrix. The cited art fails to disclose or otherwise suggests this method.

Claim 21 states that at least one of the first and second texture maps includes information based on a hexagonal sampling matrix. *Xiong* and/or the other cited art does not disclose this type of method.

Claim 70 further includes providing the first texture map further includes analyzing the texture map per at least one criterion to determine an appropriate texture resolution. *Xiong* neither discloses nor reasonably suggests such a method.

Claim 71 recites providing the first texture map further includes analyzing the texture map per at least one metric criterion to determine a requisite number of texture maps in addition to the first texture map. *Xiong* neither discloses nor reasonably suggests such.

Claim 22 is an independent claim directed towards a computer-readable medium providing computer instructions suitable for performing steps that includes providing a first texture map for a first portion of a three-dimensional surface, the first texture map being associated with a first mapping technique, and providing a second texture map for a second portion of the three-dimensional surface, the second texture map being associated with a second mapping technique that is different from the first mapping technique. *Xiong* neither discloses nor reasonably suggests such a computer-readable medium.

By way of example, as previously mentioned *Xiong* does not disclose or suggest nor would *Xiong* tolerate combining in anyway different types of map information. Instead *Xiong* selects images that share the same geometry and/or projection and then works to combined these to form a virtual panorama image. See, e.g., column 8, lines 18-33, where *Xiong* states that "the panorama is constructed on a particular geometry". The two-dimensional images and resulting three-dimensional in *Xiong* need to share a common geometry to support the blending process being taught. For example, *Xiong* teaches that overlapping rectangular images can be blended together using a blending mask after being configured in a Laplacian pyramid.

Claims 23-42, 72 and 73 depend from independent Claim 22. Consequently the exemplary reasons stated above are also applicable to these dependent claims. These dependent claims add additional elements/limitations to Claim 22 further distinguishing the claims over the cited art.

Claim 23 adds that the first texture map includes cylindrical projection information for the first portion, and the second texture map includes azimuthal projection information for the second portion. This is clearly not described by *Xiong*.

Claim 24 recites the further step of providing a third texture map for a third portion of the three-dimensional surface, the third texture map being associated with the second mapping technique, and wherein the third texture map includes azimuthal projection information for the third portion. *Xiong* and/or the other cited art does not disclose this type of computer-readable medium.

Claim 25 further specifies that the cylindrical projection information includes plane-chart projection information. This is not taught by *Xiong*.

Claim 26 further states that the azimuthal projection information includes equidistant projection information. The cited art fails to disclose or otherwise suggests this.

In **Claim 27** the first and second texture maps are stretch-invariant and have a sampling requirement definable as:

$$M_{\text{capped}}(\theta) \equiv M_{\text{equi}}(\theta) + M_{\text{plane}}(\pi/2 - \theta) = 4\theta^2 + 2\pi(\pi/2 - \theta)$$

where θ is a transition angle from a defined point on the surface to where the second texture map is adjacent to the first texture map. *Xiong* neither discloses nor reasonably suggests such a computer-readable medium. Indeed, the Office Action states that this claim is allowable if re-written in independent form.

Claim 28 further adds that θ is equal to about 45°. This is not disclosed by *Xiong*. The Office Action also states that this claim is allowable if re-written in independent form.

Claim 29 recites that providing the first texture map further includes means for hexagonally re-parameterizing the cylindrical projection information using a linear transform. This computer-readable medium is not taught nor suggested by *Xiong*. The Office Action agrees and states that this claim is allowable if re-written in independent form.

Claim 30 further recites that the linear transform is definable as:

$$\hat{\boldsymbol{S}}(u,v) \equiv \boldsymbol{S}(\boldsymbol{V}(u,v)')$$

where

$$\boldsymbol{V} \equiv \begin{bmatrix} k & k/2 \\ 0 & 1 \end{bmatrix}$$

and $k \equiv 2\sqrt{3}/3$.

Xiong neither discloses nor reasonably suggests such. The Office Action states that this claim is allowable if re-written in independent form.

Claim 31 further specifies that the first texture map includes Mercator projection information for the first portion, and the second texture map includes

stereographic projection information for the second portion. This computer-readable medium is not taught nor suggested by *Xiong*.

Claim 32 recites the further step of providing a third texture map for a third portion of the three-dimensional surface, the third texture map being associated with the second mapping technique, and wherein the third texture map includes stereographic projection information for the third portion. The cited art fails to disclose or otherwise suggests this.

Claim 33 adds that the first and second texture maps are conformal and have a sampling requirement definable as:

$$M_{\text{capped}}(\theta) \equiv M_{\text{stereo}}(\theta) + M_{\text{Mercator}}(\pi/2 - \theta) = 16\tan^2(\theta/2) + \pi\ln\left((1+\cos\theta)/(1-\cos\theta)\right)$$

where θ is a transition angle from a defined point on the surface to where the second texture map is adjacent to the first texture map. *Xiong* neither discloses nor reasonably suggests such. Indeed, the Office Action states that this claim is allowable if re-written in independent form.

Claim 34 specifies that θ is equal to about 47.8°. *Xiong* and/or the other cited art does not disclose this. The Office Action states that this claim is also allowable if re-written in independent form.

Claim 35 further recites that the cylindrical projection information includes information selected from at least one type of projection information selected from a group comprising plane-chart projection information, equal area information, and Mercator information. The cited art fails to disclose or otherwise suggests this computer-readable medium.

Claim 36 further includes that the azimuthal projection information includes information selected from at least one type of projection information selected from a group comprising equidistant projection information, stereographic projection information, gnomonic projection information, and equal area projection information. *Xiong* neither discloses nor reasonably suggests such a computer-readable medium.

Claim 37 recites that the first portion is significantly adjacent to both the first and second portions, such that the first portion separates the second and third portions. The cited art fails to disclose or otherwise suggests this.

Claim 38 recites that the three-dimensional surface is curvilinear. *Xiong* neither discloses nor reasonably suggests such a computer-readable medium.

Claim 39 further states that the three-dimensional surface includes a spherical surface. *Xiong* neither discloses nor reasonably suggests such.

Claim 40 specifies that providing the first texture map further includes generating the first texture map using the first mapping technique, and providing the second texture map further includes generating the second texture map using the second mapping technique. This further computer-readable medium is not taught nor suggested by *Xiong*.

Claim 41 recites that at least one of the first and second texture maps includes information based on a rectangular sampling matrix. This is clearly not described by *Xiong*.

Claim 42 further states that at least one of the first and second texture maps includes information based on a hexagonal sampling matrix. This computer-readable medium is not taught nor suggested by *Xiong*.

In **Claim 72** providing the first texture map further includes analyzing the texture map per at least one criterion to determine an appropriate texture resolution. This is clearly not described by *Xiong*.

In **Claim 73** providing the first texture map further includes analyzing the texture map per at least one metric criterion to determine a requisite number of texture maps in addition to the first texture map. This is not taught nor suggested by *Xiong*.

Claim 43 is an independent claim directed towards an apparatus that includes logic configured to provide a first texture map for a first portion of a three-dimensional surface, the first texture map being associated with a first mapping technique and a second texture map for a second portion of the three-dimensional surface, the second texture map being associated with a second mapping technique that is different from the first mapping technique, and wherein the logic is further configured to output graphically displayable information based on at least a portion of the first and second texture maps. *Xiong* neither discloses nor reasonably suggests such an apparatus.

By way of example, as previously mentioned *Xiong* does not disclose or suggest nor would *Xiong* tolerate combining in anyway different types of map information. Instead *Xiong* selects images that share the same geometry and/or

projection and then works to combined these to form a virtual panorama image. See, e.g., column 8, lines 18-33, where *Xiong* states that "the panorama is constructed on a particular geometry". The two-dimensional images and resulting three-dimensional in *Xiong* need to share a common geometry to support the blending process being taught. For example, *Xiong* teaches that overlapping rectangular images can be blended together using a blending mask after being configured in a Laplacian pyramid.

Claims 44-64 depend from independent Claim 43. Thus, the exemplary reasons stated above applicable to these claims also. These dependent claims add additional elements/limitations to Claim 43 further distinguishing the claims over the cited art.

Claim 44 recites that the first texture map includes cylindrical projection information for the first portion, and the second texture map includes azimuthal projection information for the second portion. *Xiong* neither discloses nor reasonably suggests such.

Claim 45 further recites that the logic is further configured to provide a third texture map for a third portion of the three-dimensional surface, the third texture map being associated with the second mapping technique, and wherein the third texture map includes azimuthal projection information for the third portion. The cited art fails to disclose or otherwise suggests this apparatus.

Claim 46 states that the cylindrical projection information includes plane-chart projection information. *Xiong* neither discloses nor reasonably suggests this.

Claim 47 specifies that the azimuthal projection information includes equidistant projection information. *Xiong* neither discloses nor reasonably suggests such.

Claim 48 further recites that the first and second texture maps are stretch-invariant and have a sampling requirement definable as:

$$M_{\text{capped}}(\theta) \equiv M_{\text{equi}}(\theta) + M_{\text{plane}}(\pi/2 - \theta) = 4\theta^2 + 2\pi(\pi/2 - \theta)$$

where θ is a transition angle from a defined point on the surface to where the second texture map is adjacent to the first texture map. *Xiong* and/or the other cited art does not disclose this type of apparatus. Indeed, the Office Action states that this claim is allowable if re-written in independent form.

Claim 49 further specifies that θ is equal to about 45°. *Xiong* neither discloses nor reasonably suggests such an apparatus. The Office Action states that this claim is also allowable if re-written in independent form.

Claim 50 states that the cylindrical projection information in the first texture map has been hexagonally re-parameterized the using a linear transform. *Xiong* neither discloses nor reasonably suggests such. The Office Action states that this claim is allowable if re-written in independent form.

In **Claim 51** the linear transform is definable as:

$$\hat{\boldsymbol{S}}(u,v) \equiv \boldsymbol{S}(\boldsymbol{V}(u,v)')$$

where

$$\boldsymbol{V} \equiv \begin{bmatrix} k & k/2 \\ 0 & 1 \end{bmatrix}$$

and $k \equiv 2\sqrt{3}/3$.

The cited art fails to disclose or otherwise suggests this apparatus. Again, the Office Action states that this claim is allowable if re-written in independent form.

Claim 52 includes that the first texture map includes Mercator projection information for the first portion, and the second texture map includes stereographic projection information for the second portion. This is clearly not described by *Xiong*.

Claim 53 further recites that the logic is further configured to provide a third texture map for a third portion of the three-dimensional surface, the third texture map being associated with the second mapping technique, and wherein the third texture map includes stereographic projection information for the third portion. This apparatus is not taught nor suggested by *Xiong*.

Claim 54 specifies that the first and second texture maps are conformal and have a sampling requirement definable as:

$$M_{\text{capped}}(\theta) \equiv M_{\text{stereo}}(\theta) + M_{\text{Mercator}}(\pi/2 - \theta) = 16\tan^2(\theta/2) + \pi\ln\left((1+\cos\theta)/(1-\cos\theta)\right)$$

where θ is a transition angle from a defined point on the surface to where the second texture map is adjacent to the first texture map. The cited art fails to disclose or otherwise suggests this apparatus. The Office Action states that this claim is allowable if re-written in independent form.

Claim 55 recites that θ is equal to about 47.8°. *Xiong* neither discloses nor reasonably suggests such an apparatus. The Office Action states that this claim is also allowable if re-written in independent form.

Claim 56 states that the cylindrical projection information includes information selected from at least one type of projection information selected from a group comprising plane-chart projection information, equal area information, and Mercator information. This is not described by *Xiong*.

Claim 57 further states that the azimuthal projection information includes information selected from at least one type of projection information selected from a group comprising equidistant projection information, stereographic projection information, gnomonic projection information, and equal area projection information. *Xiong* and/or the other cited art fail to disclose this type of apparatus

Claim 58 recites that the first portion is significantly adjacent to both the first and second portions, such that the first portion separates the second and third portions. *Xiong* neither discloses nor reasonably suggests such an apparatus.

Claim 59 further recites that the three-dimensional surface is curvilinear. *Xiong* neither discloses nor reasonably suggests such.

Claim 60 further recites that the three-dimensional surface includes a spherical surface. This is not described by *Xiong*.

Claim 61 specifies that the logic is further configured to analyze the texture map per at least one criterion to determine an appropriate texture resolution when

providing the first texture map. *Xiong* and/or the other cited art does not disclose this type of apparatus.

Claim 62 further specifies that the logic is further configured to analyze the texture map per at least one metric criterion to determine a requisite number of texture maps in addition to the first texture map when providing the first texture map. *Xiong* neither discloses nor reasonably suggests such an apparatus.

Claim 63 recites that at least one of the first and second texture maps includes information based on a rectangular sampling matrix. The cited art fails to disclose or otherwise suggests this further limitation.

Claim 64 states that at least one of the first and second texture maps includes information based on a hexagonal sampling matrix. *Xiong* neither discloses nor reasonably suggests this type of apparatus.

Claim 68 is an independent claim directed towards a method for generating a low-distortion area-preserving map for use in stochastic ray tracing computer generated graphics. The method includes projecting sampling patterns onto a three-dimensional surface, and projecting the resulting three-dimensional surface samples into two-dimensional histogram bins. *Xiong* and/or the other cited art does not disclose this type of polar-capped map set.

Claim 69 depends from independent Claim 68 and further recites projecting the sampling patterns includes a projection, $(u,v) = \boldsymbol{S}^{-1}(x,y,z)$, that is defined by the composition of at least two area-preserving bijections, wherein a first area-preserving bijection is a mapping from a hemisphere to a disk

$(u,v) = (x,y)/\sqrt{1+z}$, a second area-preserving bijection is from a disk to a half disk $(r',\theta') = (r,\theta/2)$. The cited art fails to disclose or otherwise suggests this.

Conclusion

While rejecting Claims 1-64 and 70-73 on page 3, the Office Action then states to the contrary on page 6 that Claims 6-9, 12-13, 27-30, 33-34, 48-51, and 54-55 would be allowable if re-written in independent form. If needed, clarification of these conflicting statements is respectfully requested

However, this clarification is probably not needed since, for at least the exemplary reasons presented above, all of the pending claims are clearly patentable over the cited art. It is respectfully requested, therefore, that the rejections and objections be reconsidered and withdrawn and the patent application be allowed.

Respectfully Submitted,

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